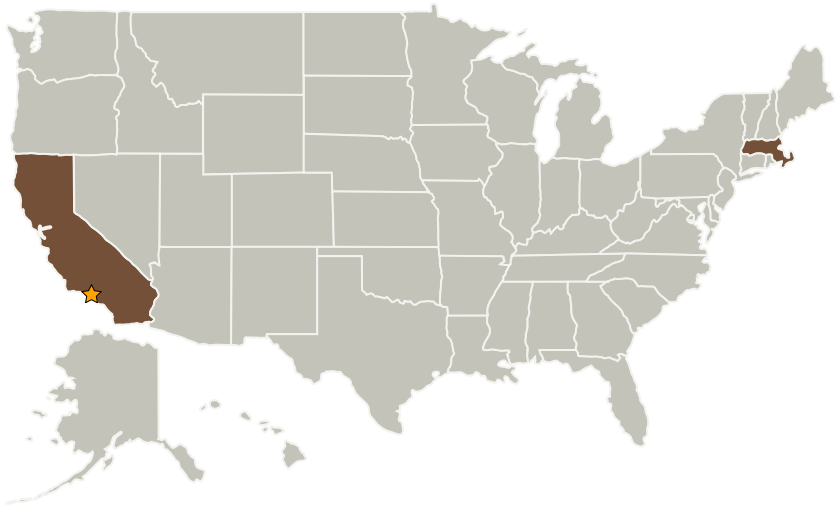
High-Counting Rate Photon Detectors for Long-Range Space Optical Communications, Phase I

Completed Technology Project (2007 - 2007)

Project Introduction

Long range, RF space communications do not meet anymore the bandwidth requirements or power constraints of future NASA missions. Optical communications offer the potential to dramatically increase the link bandwidth and decrease the emitter power. High-bandwidth, long-range optical communications require reliable high-gain, photon-counting detectors operated at moderate cooling with high detection efficiency, large aperture, sub-nanosecond temporal resolution, low intrinsic noise, and capability to handle large optical background. These requirements have not been met yet by single detector designs. We propose to develop a novel large area, photon-counting detector in infrared, operated with moderate cooling, gain greater than 10^6, detection efficiency greater than 50%, 100 MHz saturation counting rate, at least 500 MHz bandwidth, and configurable area. The approach is to develop compact, photon-counting detector arrays based on designs processed in high-volume manufacturing with validated reliability and infrared converters processed on large silicon wafers. This innovation provides a simple solution to high-bandwidth ground-space and space-space optical communications by mitigating optical aperture -- additive noise requirements. In Phase I, we will investigate the integration of the infrared converter into the photon detector processing flow, and will develop the electronics to increase the detector bandwidth and its saturation-counting rate.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California
aPeak, Inc.	Supporting Organization	Industry	Newton, Massachusetts

Primary U.S. Work Locations	
California	Massachusetts

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - TX05.1 Optical Communications
    - TX05.1.1 Detector Development